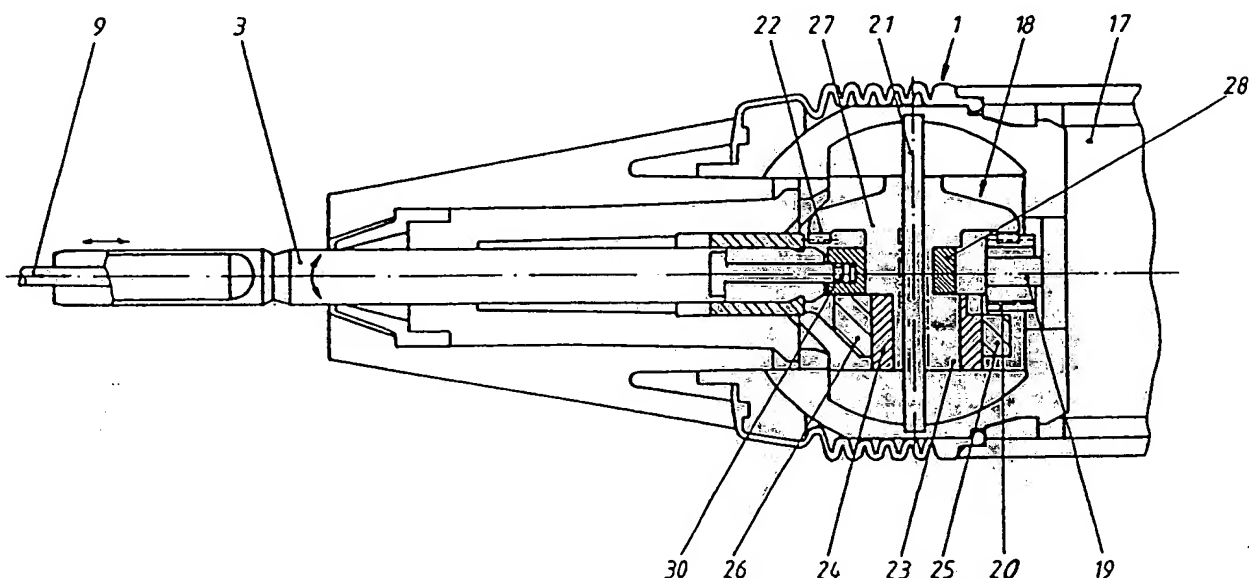


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<p>(21) International Application Number: PCT/EP92/02780  (22) International Filing Date: 2 December 1992 (02.12.92)  (30) Priority data: P 41 39 788.6 3 December 1991 (03.12.91) DE  (71) Applicant (for all designated States except US): BAUSCH &amp; LOMB INCORPORATED [US/US]; One Lincoln First Square, Rochester, NY 14601-0054 (US).  (72) Inventor; and (75) Inventor/Applicant (for US only) : HOMMANN, Edgar [CH/CH]; Reuenberg, CH-3257 Grossaffoltern (CH).  (74) Agent: SCHLAGWEIN, Udo; Frankfurter Straße 34, D-6350 Bad Nauheim (DE).</p>		<p>(81) Designated States: AU, BB, BG, BR, CA, CS, FI, HU, JP, KP, KR, LK, MG, MN, MW, NO, PL, RO, RU, SD, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).</p> <p>Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>

(54) Title: ELECTRIC TOOTHBRUSH



(57) Abstract

An electric toothbrush comprises a handle part (1) and a push-on brush (4). From one end of the handle part (1) there projects the end of a hollow shaft (3) in which a toothbrush arbor (9) is coaxially arranged, the push-on brush (4) being adapted to be pushed on to the toothbrush arbor (9). The push-on brush (4) has a rotatable tuft of bristles which may be driven by a longitudinally reciprocating connecting rod. A gear (18) in the handle part (1) has two cams (23, 27) which are mutually phase shifted by 180°. The first cam (23) displaces the hollow shaft (3) and the second cam displaces the toothbrush arbor (9) in the opposite direction.

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Title: Electric Toothbrush

The invention relates to an electric toothbrush with a manually guidable handle part having a motor and a gear, and a push-on brush which is to be fastened thereon and  
5 which has a plurality of rotatably arranged bristle holders which each have an eccentric peg engaging in transversely extending grooves in a connecting rod which may be caused to reciprocate in the direction of its longitudinal axis by the gear by means of a toothbrush  
10 arbor and a first cam.

EP-A-9357863 relates to a toothbrush of this type. With the known toothbrush, the push-on brush may be pushed rotatably round its longitudinal axis by means of a locking connection onto the front region of the casing  
15 of the handle part. The toothbrush arbor and therefore also the connecting rod are caused to oscillate round their longitudinal axis and also to reciprocate in the direction of the longitudinal axis by means of a rocker and a cam engaging therein. The reciprocating movement  
20 of the connecting rod is converted into an alternating rotational movement of the tufts of bristles in the brush head of the push-on brush while the oscillating movement of the connecting rod leads to a corresponding oscillating movement of the entire push-on brush.

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The drive of the tufts of bristles by a connecting rod leads to problems if the individual tufts of bristles are to be rotated to and fro with a greater angle of rotation. For this purpose, it is necessary to increase  
5 the stroke of the connecting rod by increasing the stroke of the toothbrush arbor, and this can give rise to greater eccentricity of the cam of the gear and can therefore lead to an undesirable increase in the size of the gear.

10 It is known from German Patent Application P 41 38 021.5, which has not been anticipated, to dispense with the connecting rod for increasing the rotational angle of the tuft of bristles and instead to drive the tufts of bristles by means of a rotatable  
15 shaft. However, as toothbrushes with a connecting rod having transverse grooves and eccentric members of the bristle holders engaging therein have proven appropriate, attempts have been made to maintain this principle of production of the alternating rotational  
20 movement of the tufts of bristles.

The object of the invention is to design a toothbrush of the type mentioned at the outset such that a stroke of its connecting rod which is as great as possible may be achieved with a gear which is as compact as possible.

25 According to the invention, this object is achieved by providing an electric toothbrush comprising a manually guidable handle part, having a motor and a gear, and a push-on brush having a stem part adapted to be fitted to the handle part and a plurality of rotatably arranged  
30 bristle holders which each have an eccentric peg, a

connecting rod extending through the stem part and having a plurality of transversely extending grooves in each of which an eccentric peg of a respective bristle holder is engaged, said connecting rod being caused to  
5 reciprocate in the direction of its longitudinal axis by the gear by means of a toothbrush arbor and a first cam, wherein the stem part of the push-on brush is adapted to be pushed onto a hollow shaft through which the toothbrush arbor extends and which is displaceably  
10 arranged in the handle part and wherein the gear has a second cam which is offset from the first cam by  $180^{\circ}$  for the displacement of the toothbrush arbor in the direction of its longitudinal axis and in the opposite direction to the displacement of the hollow shaft.

15 The hollow shaft enables the push-on brush to be displaced independently in the direction of its longitudinal axis by displacement of the hollow shaft. In this way, the two cams offset by  $180^{\circ}$  allow the connecting rod to be moved forwardly when the hollow  
20 shaft and therefore the push-on brush move backwardly. A relative movement between the connecting rod and push-on brush thus occurs which, if the eccentricity of the cams is equal, is twice as great as the reciprocating movement of the connecting rod. Owing to the invention,  
25 therefore, a large rotational angle of the bristle holders may be achieved with a connecting rod without undesirably great eccentricity being required for this purpose.

The hollow shaft performs an elliptical movement with  
30 the push-on brush while the bristle holders with the tufts of bristles rotate in alternate directions of rotation if, according to an advantageous development of

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the invention, the gear has a gear wheel which is arranged to be driven by a pinion mounted on the drive shaft of the motor to revolve around an axis of rotation extending transversely to the main direction of the handle part, said gear wheel being designed as a bevel wheel or crown wheel and the first cam extending parallel to the axis of rotation of the gear wheel, if the first cam engages in a receiver in a rocker connected to the hollow shaft in an orientation parallel to the axis of rotation of the gear wheel and if the second cam extends parallel to the said axis and engages in a slot of a link block extending transversely to the toothbrush arbor and rigidly connected to one end thereof.

The electric toothbrush may be guided particularly conveniently and without contortion of the arm if, according to a further development of the invention, the handle part consists of a hand piece and a front piece and if the front piece is designed to pivot to a limited extent relative to the hand piece about a pivot axis aligned with the axis of the gear wheel.

The invention will now be described in detail, by way of example, with reference to the drawings, in which:-

Figure 1 is a perspective view of one embodiment of a toothbrush according to the invention;

Figure 2 is an exploded perspective view of the push-on brush part of the toothbrush shown in Figure 1;

Figure 3 is a longitudinal section through the gear region of the toothbrush; and

Figure 4 is a plan view of a link block of the gear.

Referring to the drawings, Figure 1 shows an electric toothbrush in the not yet assembled state with a manually guidable handle part 1 having a switch 2 for  
5 switching the electric toothbrush on and off. From the handle part 1 there projects a hollow shaft 3 onto which a push-on brush 4 may be pushed which is held on the hollow shaft 3 by a locking connection (not shown) in the pushed-on state.

10 The push-on brush 4 has a brush head 5 with a plurality of tufts of bristles 6 arranged rotatably therein. For driving the tuft of bristles 6 there is arranged in the push-on brush 4 a connecting rod 7 which is illustrated in broken lines and which is adapted to be coupled by  
15 means of a coupling 8 to a toothbrush arbor 9 arranged coaxially to the hollow shaft 3 in the handle part 1.

The hollow shaft 3 is driven such that it performs an oscillating movement round its longitudinal axis and at the same time reciprocates in the direction of its  
20 longitudinal axis. This displacement of the hollow shaft 3 is phase shifted by  $180^{\circ}$  relative to a reciprocating displacement of the connecting rod 7 also extending in the longitudinal direction.

Figure 1 shows that the handle part 1 consists of a hand  
25 piece 10 and a front piece 11. This front piece 11 is pivotal to a limited extent round a pivot axis 12 extending transversely to the longitudinal axis of the toothbrush. The differences in spacing occurring between hand piece 10 and front piece 11 are compensated  
30 by a bellows 13.

Figure 2 shows how a rotational movement is produced from a reciprocating movement by means of the connecting rod 7. This part of the electric toothbrush shown in Figure 2 corresponds completely to that in EP-A-0357863.

5 It can be seen that the connecting rod 7 has a total of five transversely extending grooves 13, 13a, 13b, 13c, 13d which are arranged in succession at its brush head end and into which there engage eccentric pegs 14 projecting from bristle holders 15 holding the tufts of  
10 bristles 6. The bristle holders 15 may be inserted from below into holes 16 in an insert 31 which, in turn, is held in the brush head 5.

Figure 3 shows a section through a front region of the handle part 1 with a motor 17 which is arranged to drive  
15 the hollow shaft 3 and the toothbrush arbor 9 via a gear 18. The motor 17 has a motor shaft 19 with a pinion 20. The pinion 20 continuously drives a gear wheel 22 which is rotatably mounted on a shaft 21 which in turn is fixedly mounted in the handle part and extends  
20 transversely to the longitudinal axis of the said handle part 1, the gear wheel 22 being designed as a bevel wheel or crown wheel. A first cam 23 which engages in a sliding block 24 of a rocker 25 is provided parallel to the axis on the gear wheel 22. The rocker 25 extends  
25 parallel to the hollow shaft 3 and is rigidly connected to it by a radial connecting piece 26. The shaft 21 simultaneously forms the pivot axis 12 shown in Figure 1. The exact configuration of this part of the gear 18, which is to be called a push/rock type gear, is  
30 described in the above-mentioned EP-A-0357863. The hollow shaft 3 performs an elliptical movement owing to the known push/rock type gear.



It is important for the invention that the gear wheel 22 has a second cam 27 which is phase-shifted by  $180^{\circ}$  relative to the first cam 23. A link block 28, the design of which is shown in Figure 4, rests on the  
5 second cam 27. As shown therein, the link block 28 has a link guide 29 which extends transversely to the longitudinal axis of the hollow shaft 3 and in which the second cam 27 shown in Figure 3 engages. The link block 28 has, on the side of the toothbrush arbor 9, a peg 30  
10 which is also shown in Figure 3 and in which one end of the toothbrush arbor 9 engages.

When the gear wheel 22 rotates, the second cam 27 causes the link block 28 to reciprocate in the longitudinal direction of the toothbrush so the toothbrush arbor 9  
15 performs a corresponding displacement. At the same time, the first cam 23 causes the hollow shaft 3, which is phase shifted by  $180^{\circ}$ , to reciprocate so that a relative movement takes place between the hollow shaft 3 and therefore the toothbrush head 5 and the connecting  
20 rod 7 which corresponds to the sum of the eccentricities of the two cams 23, 27.

CLAIMS

1. An electric toothbrush comprising a manually guidable handle part, having a motor and a gear, and a push-on brush having a stem part adapted to be fitted to the handle part and a plurality of rotatably arranged  
5 bristle holders which each have an eccentric peg, a connecting rod extending through the stem part and having a plurality of transversely extending grooves in each of which an eccentric peg of a respective bristle holder is engaged, said connecting rod being caused to  
10 reciprocate in the direction of its longitudinal axis by the gear by means of a toothbrush arbor and a first cam, wherein the stem part of the push-on brush is adapted to be pushed onto a hollow shaft through which the toothbrush arbor extends and which is displaceably  
15 arranged in the handle part and wherein the gear has a second cam which is offset from the first cam by  $180^{\circ}$  for the displacement of the toothbrush arbor in the direction of its longitudinal axis and in the opposite direction to the displacement of the hollow shaft.

2. An electric toothbrush according to claim 1, wherein the gear has a gear wheel which is arranged to be driven by a pinion mounted on a drive shaft of the motor to revolve around an axis of rotation extending  
5 transversely to the main direction of the handle part, said gear wheel being designed as a bevel wheel or crown wheel and the first cam extending parallel to the axis of rotation of said gear wheel, wherein the first cam engages in a receiver in a rocker connected to the  
10 hollow shaft in an orientation parallel to the axis of rotation of the gear wheel and wherein the second cam extends parallel to the said axis and engages in a slot of a link block extending transversely to the toothbrush arbor and rigidly connected to one end thereof.

3. An electric toothbrush according to claim 2,  
wherein the handle part consists of a hand piece and a  
front piece and the front piece is pivotal to a limited  
extent relative to the hand piece about a pivot axis  
5 aligned with the axis of rotation of the gear wheel.

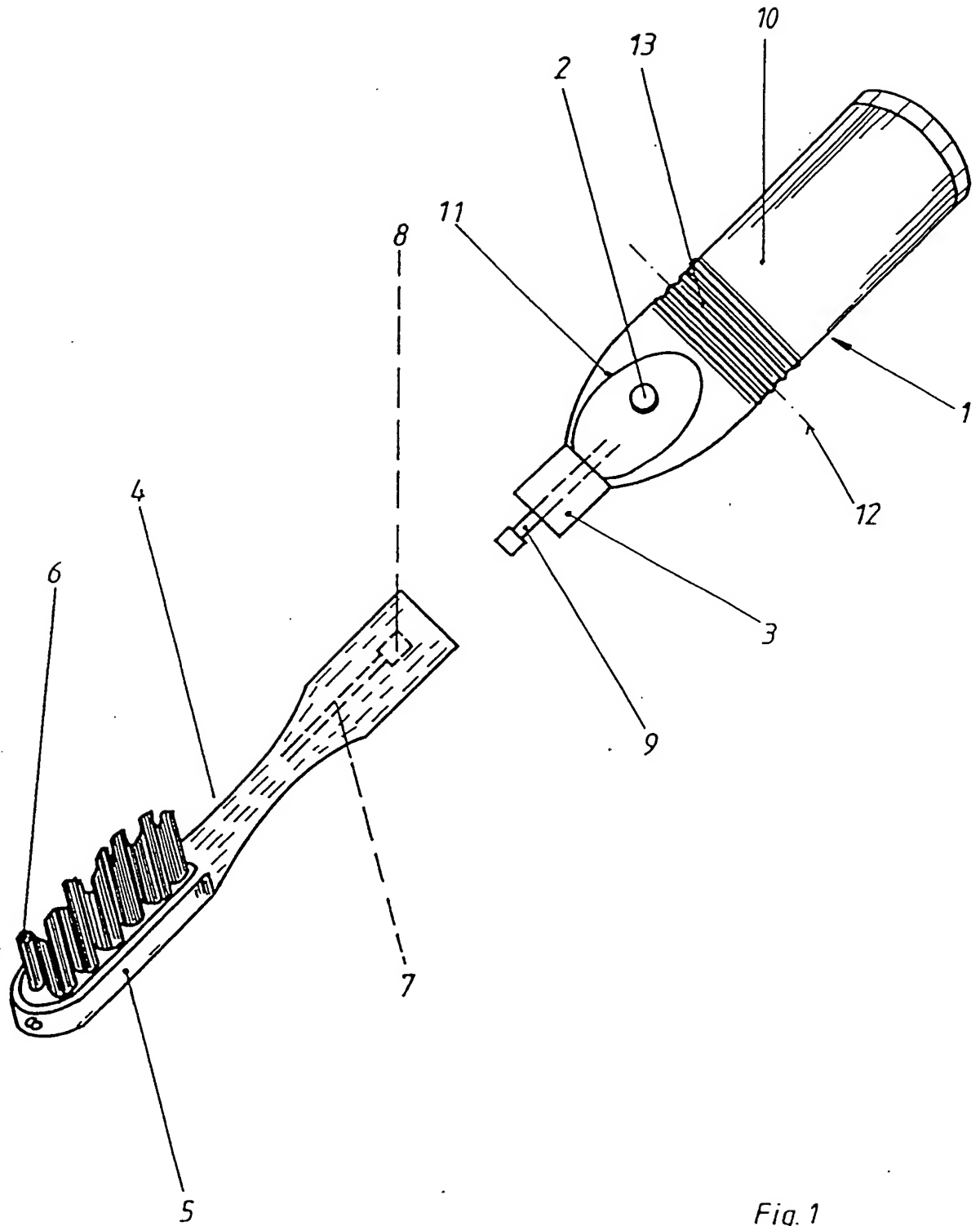
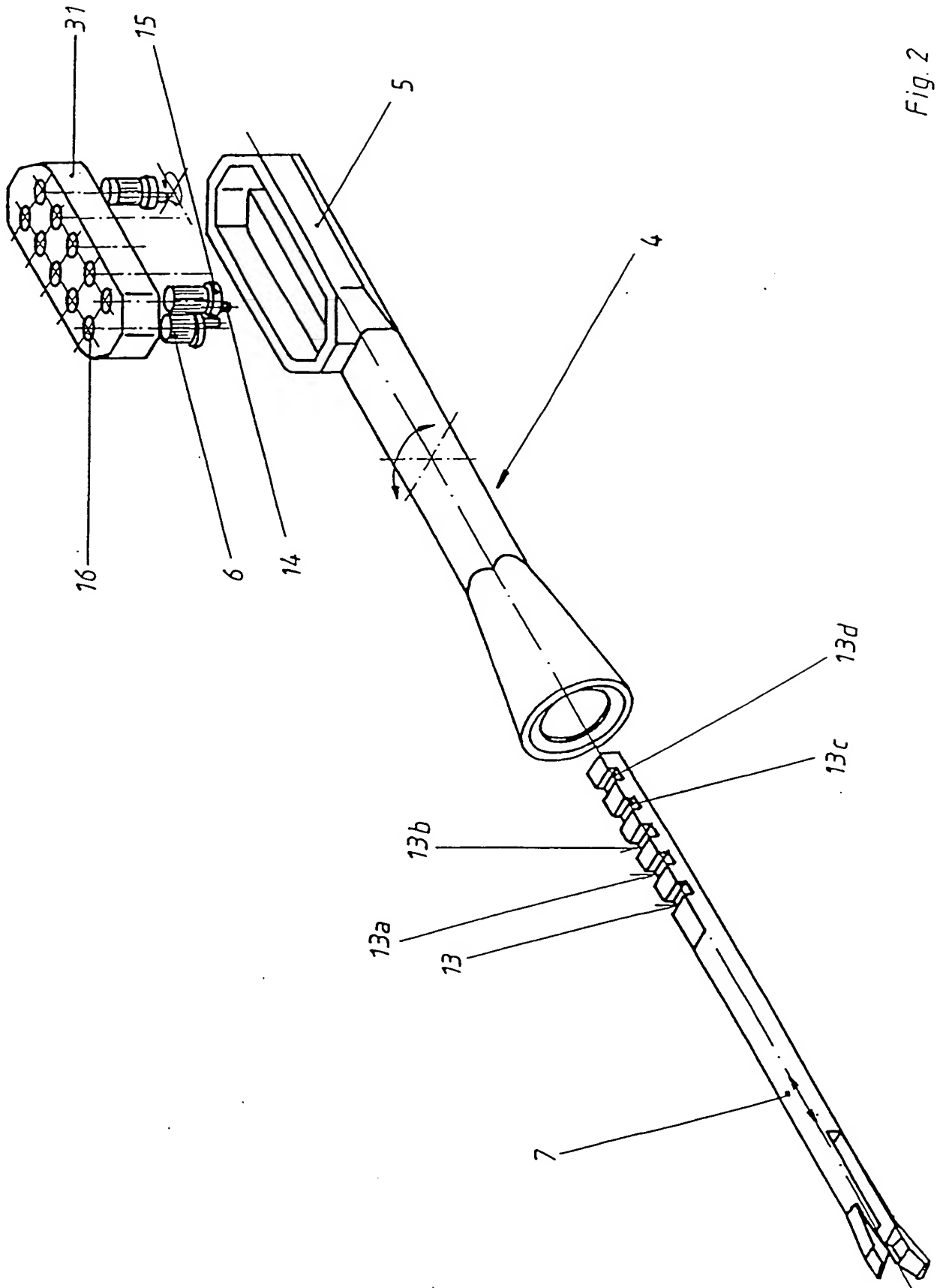


Fig. 1



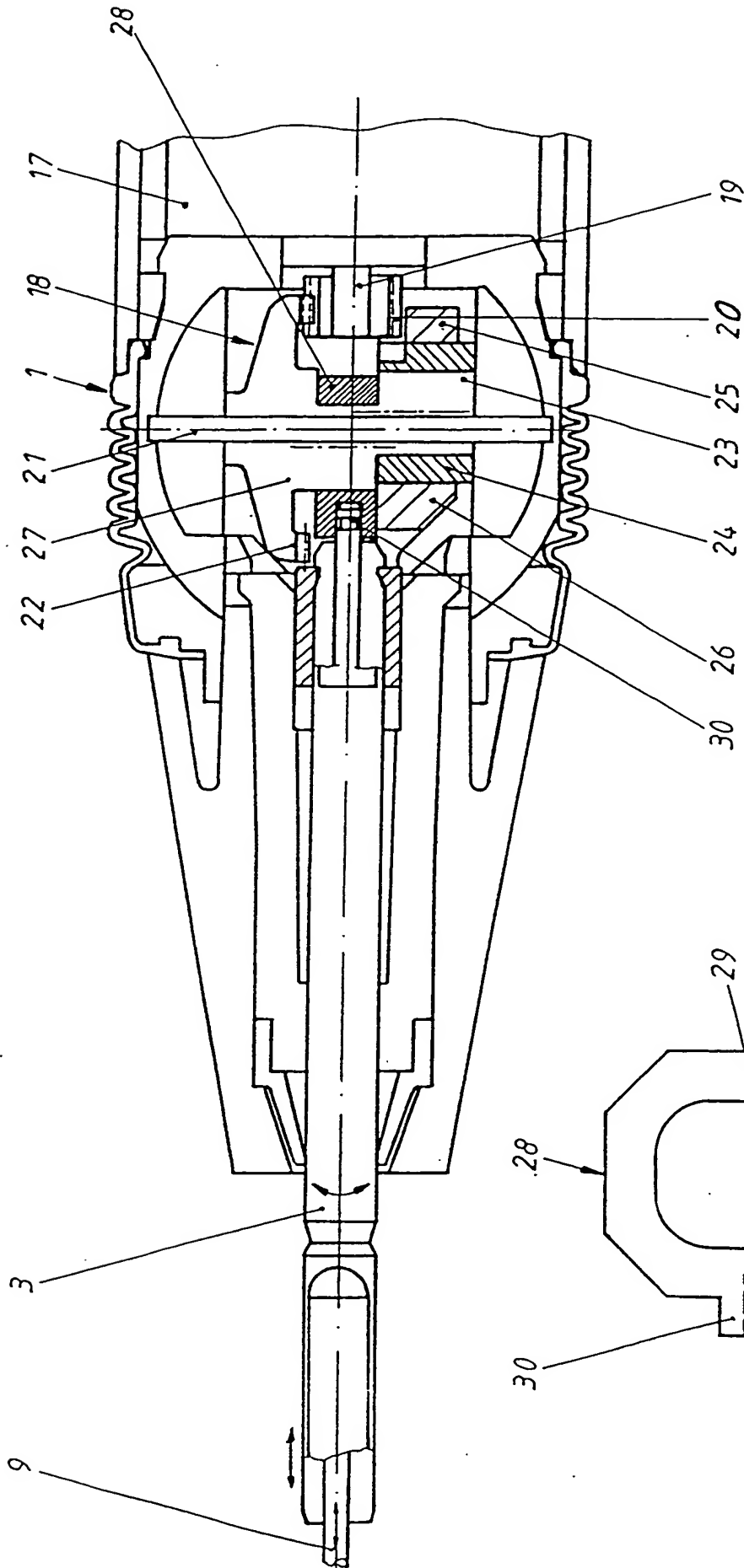


Fig. 3

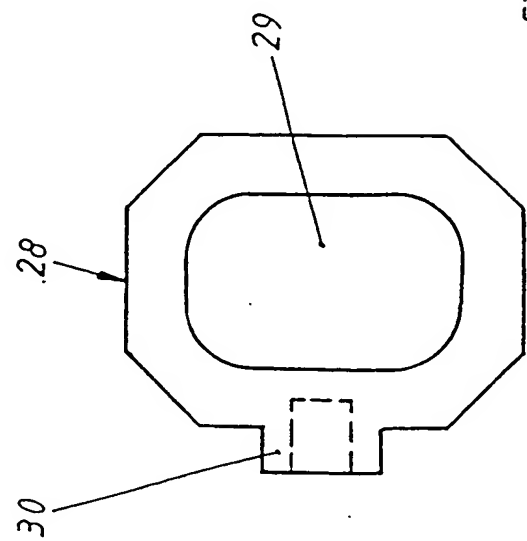


Fig. 4

## INTERNATIONAL SEARCH REPORT

PCT/EP 92/02780

International Application No

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 A61C17/34		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	A61C	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	EP,A,0 357 863 (GIMELLI) 14 March 1990 cited in the application ---	1
A	EP,A,0 378 101 (GIMELLI) 18 July 1990 ---	
A	US,A,4 156 620 (CLEMENS) 29 May 1979 -----	
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<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
26 MARCH 1993		02.04.93
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# ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

EP 9202780  
SA 68405

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0357863	14-03-90	DE-A- 3830649	15-03-90
		AU-B- 617521	28-11-91
		AU-A- 4106189	15-03-90
		JP-A- 2114908	27-04-90
		US-A- 4989287	05-02-91
EP-A-0378101	18-07-90	DE-U- 8900234	02-03-89
		AU-B- 630909	12-11-92
		AU-A- 4762590	19-07-90
		CA-A- 2007518	11-07-90
		JP-A- 2234709	17-09-90
		US-A- 5020179	04-06-91
US-A-4156620	29-05-79	None	